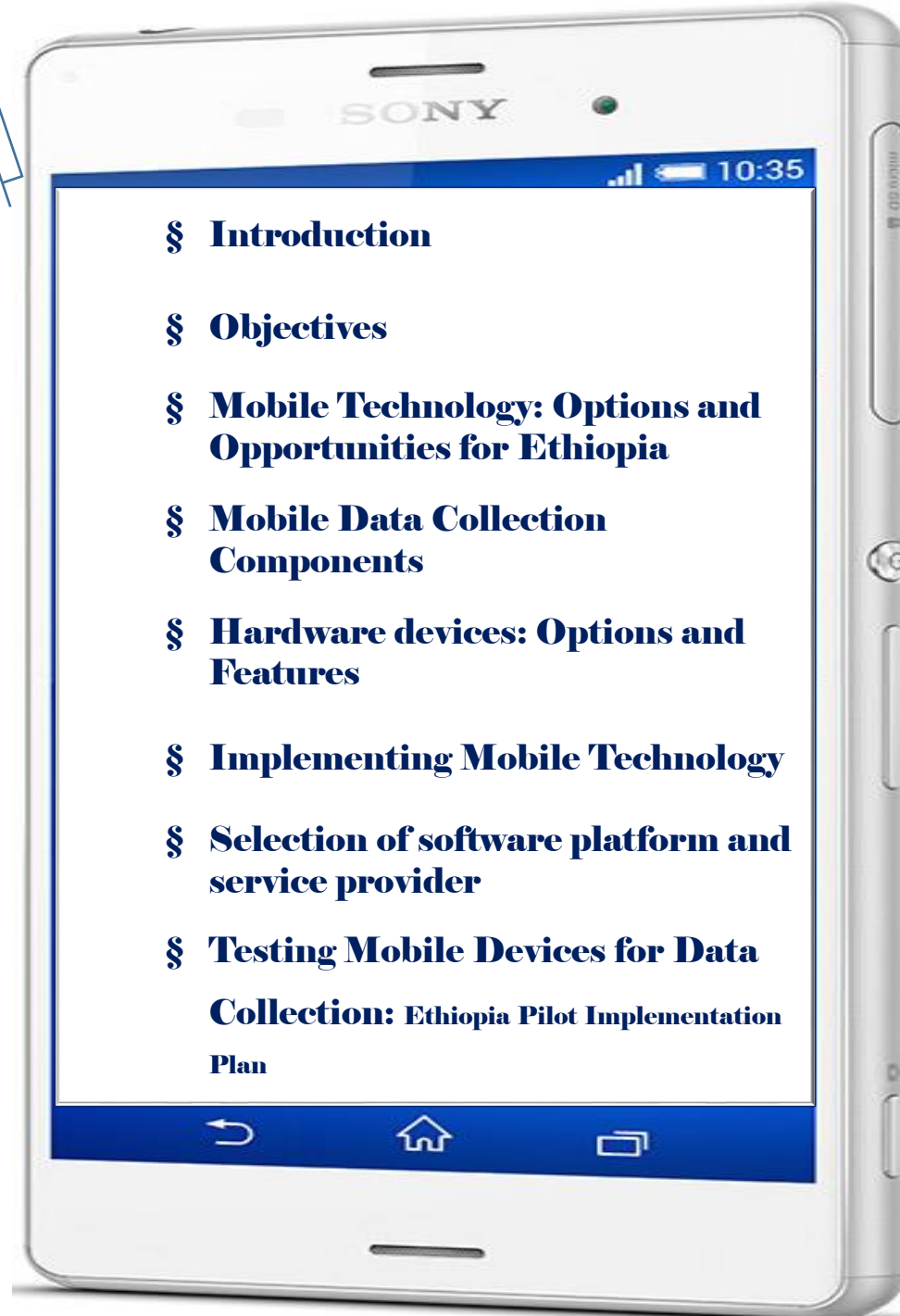
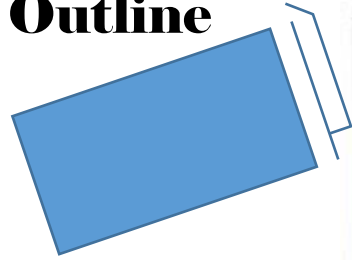




Mobile Technology for Data Collection: Options and Opportunity

Zelalem Destaw, ESA

Outline



Introduction

- *Era of: Big data, Open data*
 - ✓ *Evidence based policy formulation and decision making needs availability of data*
 - ✓ *CSA has been employing several surveys based on the demand from gov't/ sectorial ministries*
 - ✓ *Paper and Pen based Survey:*
 - ✓ *costly, time taking, Environmentally unfriend as the printouts voided,*
 - ✓ *logistics deployment and management*
 - ✓ *However, timely and reliable data is highly important for:*
 - *monitoring development interventions, program impact evaluation, policy formulation ...*

Intro ...

✓ Development Agents/ NGOs and Donors:

- *Mobile based monitoring and management system within their existing budget makes them effective*
- *Field level data in real time about their projects*
- *Access ongoing data, instead of one time annual report, and*
- *Understand the real impact of the support*
- *Access monitoring data by requesting “anytime and anywhere”*
- *Introduces high degree of transparency and accountability*

✓ Way has to be built for: cost effective, timely efficient, easily accessible data gathering

✓ Recently, mobile based Data collection system has been established

✓ Data collection practices using CAPI, PDA, ...

✓ Widening this experiences, adopting recently developed electronic technology

(from PDA to latest windows/ android device use)

Objectives

- ✓ *The CSA undertakes mobile data collection projects: eg price statistics*
- ✓ *This project will fit well with the ongoing activities, with the required thematic and geographic focus.*

- ✓ *Thus, the objective of this pilot study is:*
 - *Improve the capabilities of Ethiopia to use mobile technologies to make statistical data available and accessible to support its sustainable development agenda.*
- ✓ *Purpose of the launching workshop:*
 - *Get ideas and share experiences among stakeholders who have started applying the technology, and*
 - *Identify local partners*

Mobile Technology: Options and Opportunities

- *Paper or Mobile? Which format is better?*

Some criteria:

(a) Easy to develop and field-test questionnaires upfront



Paper

- ◆ Provides maximum flexibility in formatting the questionnaire
- ◆ Can be shared and developed in collaboration with others
- ◆ Can be printed and tested immediately

Mobile or Tablet

- ◆ Follow standard formats – to fit mobile or tablet screens
- ◆ Requires using software tools that make it difficult to collaborate
- ◆ Can be tested only after deploying mobile-devices in the field

(b) Allows for unstructured, impromptu notes and qualitative data



Paper

- ◆ Writing on paper is easier
- ◆ Field staff can fill in notes later on paper-forms
- ◆ Responses can be written in local languages

Mobile or Tablet

- ◆ Typing through keypad or keyboard is slow
- ◆ Local language inputs at time of data collection are difficult
- ◆ Handwriting recognition software is still in its infancy

Mobile Technology: Options and ...

(c) Manage large surveys across regions with large number of surveyors

Paper

- ◆ Logistics of printing and tracking paper-questionnaires is tedious
- ◆ Real-time tracking of survey work is difficult
- ◆ Survey questionnaires cannot be changed once deployed without significant re-printing cost



Mobile or Tablet

- ◆ Can be deployed remotely to mobiles or tablets. Survey work can be tracked in real time
- ◆ If necessary questionnaires can be changed even with surveyors in the field

(d) Data quality is paramount

Paper

- ◆ Cannot control or limit logical flow of questions on paper
- ◆ Can have issues in deciphering hand-written selections and text
- ◆ Requires data entry – another source of error
- ◆ Requires manual scrutiny of surveys to check for errors and missing data
- ◆ Effective monitoring–audit and tracking, of data can be a laborious and complicated process



Mobile or Tablet

- ◆ Set logical question flow–thereby making non-applicable questions hidden from surveyor
- ◆ Set validation checks for answers entered, prompt enumerators if answers do not match 'pre-filled' previous data
- ◆ Some data cleaning is already completed due to these features built into the software
- ◆ Real-time data checking, allows for prompt review of data quality and makes auditing and respondent tracking procedures more nimble

Mobile Technology: Options and ...

(e) Cost and Time

Paper

- ◆ No one-time 'hardware' cost
- ◆ Ongoing costs of printing, transporting and storing paper questionnaires
- ◆ Data-entry operations take significant time and resources—training, data-entry operators, transliterating local languages, ensuring quality through double data entry, and reconciliation through hard copy checks.
- ◆ Longer time-frame before data is available for analysis



Mobile or Tablet

- ◆ Initial one-time cost of mobile or tablet devices
- ◆ Additional costs for maintenance such as batteries and replacement due to loss of devices
- ◆ Ongoing data-plan costs, and service-provider costs
- ◆ Real-time access to data to monitor quality and progress
- ◆ Environmentally friendly as printing surveys is avoided

(f) Ability to collect new data types: Location (GIS), Media (Photos, etc.)

Paper

- ◆ Requires additional hardware devices such as GPS devices, cameras, etc., for collecting non-text data types
- ◆ Non-text data types difficult to integrate



Mobile or Tablet

- ◆ Single device with other multimedia such as GPS, audio, and video tools
- ◆ Non-text data can be integrated with text data in real time
- ◆ Real-time access to location, photos, etc., provide can collect text as well as tie
- ◆ verification

Mobile Technology: Options and ...

New data types

*Mobile data collection offers three new data types:
Very useful for M & E*

✓ *Geographic data: locations, paths & boundaries*

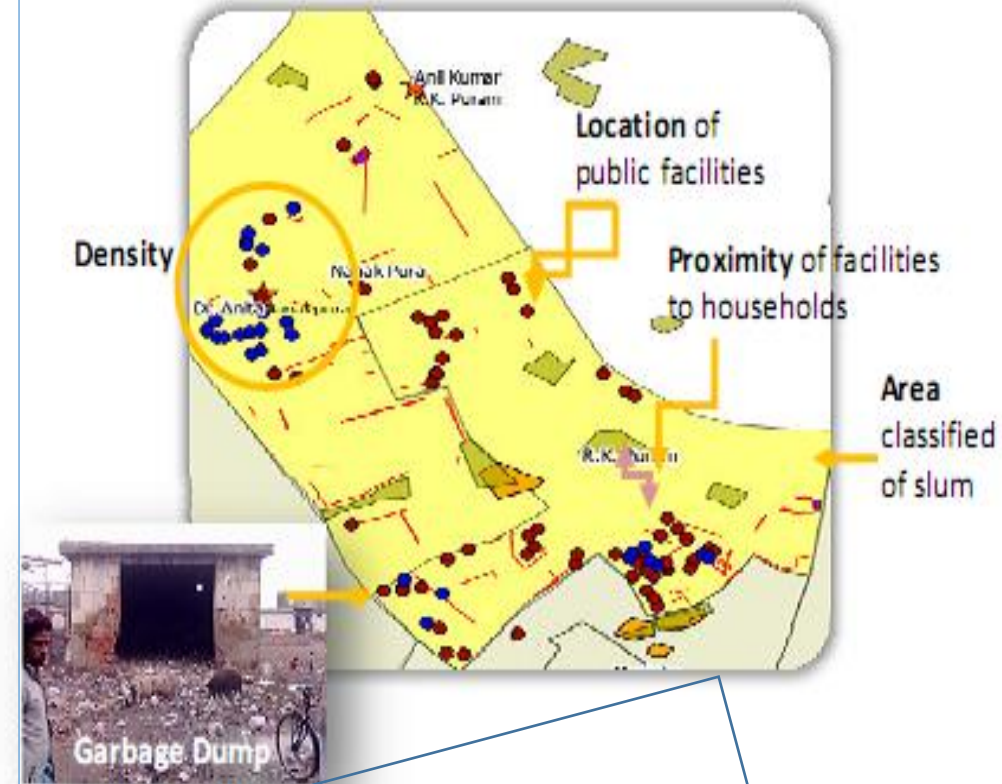
- *Latitude, longitude, altitude*
- *Able to abstract indicators using GIS*

✓ *Multimedia data: photos, audio recordings, videos, etc*

- *Rich qualitative data*
- *Audit & verification purpose*

✓ *Electronic sensors:*

- *Have built-in sensors: light sensors*
- *Can be enhanced by external add-ons - fingerprints scanners, smart card readers*



- Indicators:**
- Location & verification
 - Prevalence & density
 - Areas & proximity
 - spread & Terrain (geo attributes)
 - Networks

Mobile Data Collection Components

Four components are required:

Hardware devices:

- ✓ Ranges from 'low end phones' to 'Point of Sale' (PoS) terminals
- ✓ Enter data
- ✓ Can be linked to add-on devices: biometric sensors, recording devices for finger print scanners, videos, pictures, smart cards, ...

Data collection software

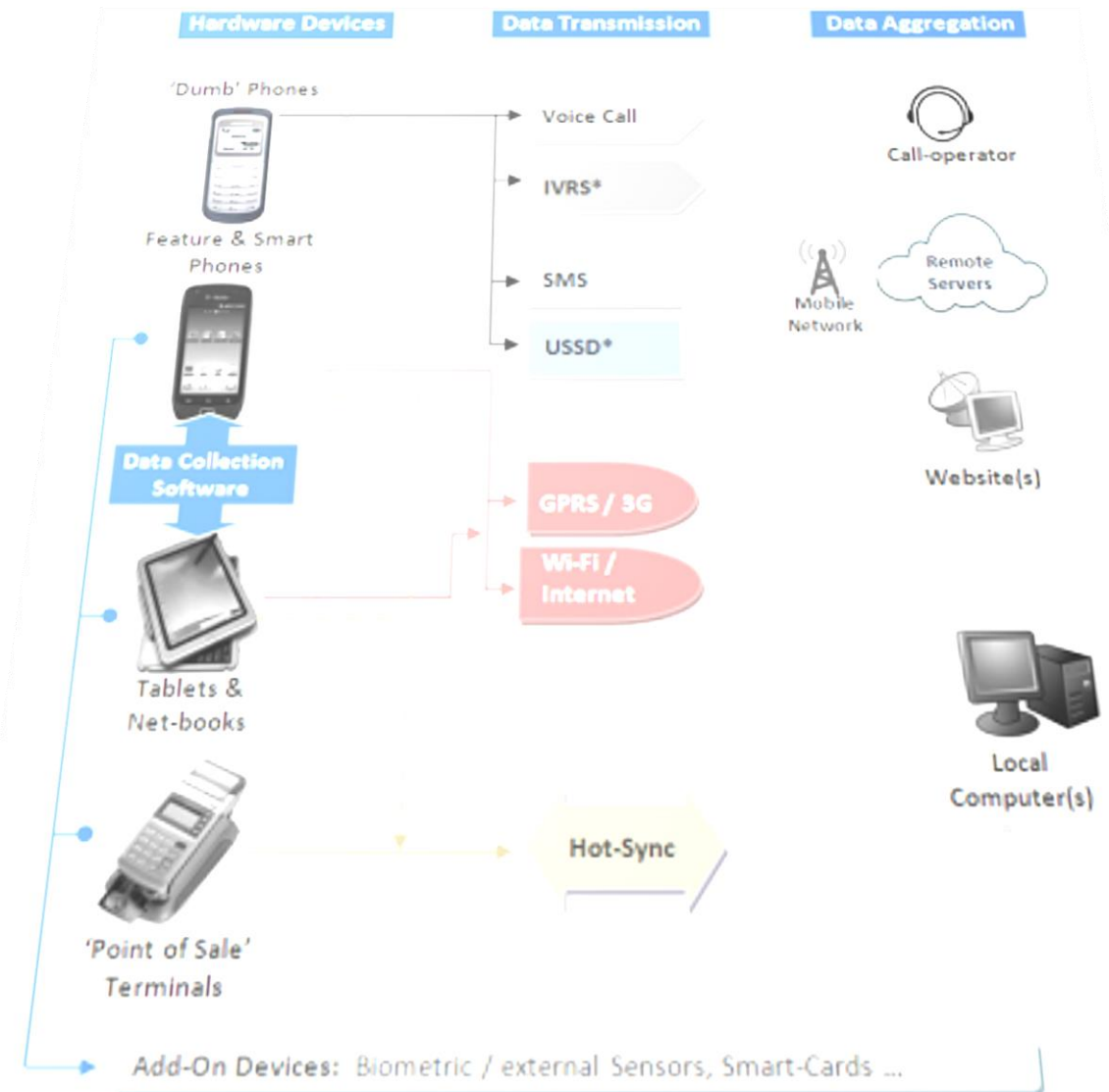
- ✓ Controls data entry based on programmed formats and rules (repeating questions, skips, answer limits & validations, pre-loading of data, ...)
- ✓ Can be installed for Android mobiles/ Windows tablets
- ✓ Not required in 'Low-end phones' - send data through SMS or IVRS

Data transmission

- ✓ Transfer field level data to a remote/ single central computer
- ✓ Need mobile networks/ internet (for PoS - hot-syncing cables)

Data aggregation and Analysis

- ✓ Receive, collate and analyze collected data on a server
- ✓ Can be done remotely through SMS, Mobile internet gateways on web servers with online database/ or statistical software on local computers



* Interactive Voice Response System | * Unstructured Supplementary Service Data

Hardware devices: Options and Features

<i>Options</i>	<i>Low-end phones</i>	<i>Smart phones</i>	<i>Tablets</i>	<i>Notebooks</i>
<i>Screen</i>	<i>Small gray scale</i>	<i>Touch screen</i>	<i>Large touch screen</i>	<i>Large screen</i>
<i>Data Entry</i>	<i>Keypad</i>	<i>Touch keyboard</i>	<i>Touch keyboard</i>	<i>Keyboard</i>
<i>Make Calls</i>	<i>Yes</i>	<i>Yes</i>	<i>Depends: Needs SIM card slot (space)</i>	<i>No</i>
<i>Mobile Internet</i>	<i>No</i>	<i>Yes</i>	<i>Depends: Needs SIM card slot (space)</i>	<i>No</i>
<i>Internet (Wi-Fi or Cable)</i>	<i>No</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
<i>Apps and data collection software</i>	<i>No</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
<i>Track location (GPS)</i>	<i>No</i>	<i>Yes</i>	<i>Depends: Some models do not have GPS capabilities</i>	<i>No</i>
<i>Capture photo and media</i>	<i>No</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
<i>Connect to external devices (Printers, Finger print scanners, etc)</i>	<i>No</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
<i>Hot-sync data to other devices</i>	<i>No</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>
<i>Battery life</i>	<i>Full day</i>	<i>Half day</i>	<i>8 - 10hrs</i>	<i>4 - 5hrs</i>

Data Transmission: Options and Features

<i>Options</i>	<i>Mobile Internet</i>	<i>Internet</i>	<i>Hot-Sync</i>
<i>Set up time</i>	<i>None</i>	<i>None</i>	<i>None</i>
<i>Set up cost</i>	<i>None</i>	<i>Low: Cable or modem</i>	<i>None</i>
<i>Ongoing cost</i>	<i>Fixed: Data plan</i>	<i>Fixed: Data plan</i>	<i>None</i>
<i>Receive data from device</i>	<i>Yes</i>	<i>Yes</i>	<i>Cable connect</i>
<i>Send data to device on request</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>

Components: Summary

<i>Device</i>	<i>Software</i>	<i>Transmission</i>	<i>Aggregation</i>
<i>Low-end phones</i>	<i>None</i>	<i>SMS</i>	<i>Remote server</i>
<i>Smart Phone</i>	<i>Data Entry App</i>	<i>Mobile Internet</i>	<i>Remote server</i>

Components: Summary

<i>Device</i>	<i>Advantage</i>	<i>Disadvantage</i>
<i>Low-end phones</i>	<ul style="list-style-type: none">- <i>Can work with any mobile handset</i>- <i>No hardware cost</i>- <i>Low set up time</i>- <i>Immediate access to data</i>- <i>No additional costs for scale up</i>	<ul style="list-style-type: none">- <i>High SMS cost</i>- <i>Possibility of SMS entry errors (specially for longer content)</i>- <i>Quality control difficult</i>
<i>Smart Phone with mobile apps</i>	<ul style="list-style-type: none">- <i>Easy data input interface</i>- <i>Low set up time and immediate data access</i>- <i>Control over devices and cost</i>- <i>Collect location or photo data for verification</i>- <i>Better data quality</i>	<ul style="list-style-type: none">- <i>Handset costs</i>- <i>Ongoing cost of subscribing to mobile data plans (GPRS/ 3G)</i>- <i>Higher possibility of handsets to be stolen (expensive)</i>

Implementing Mobile Technology

- *Identifying right technology service provider*
 - *Hardware providers: Phones, computers*
 - *Software vendors for data collection, and if required for data collation and reporting*
 - *Data transmission service providers: Mobile internet*
 - *Web-hosting services for data aggregation and storage*
- *Estimating costs*
 - *Hardware, software, transmission, aggregation, management costs*
- *Planning timeliness*
- *Training & piloting*
- *Ensuring data quality*
- *Ensuring data security*

Selection of software platform and service provider

Survey question types and Data quality:

- ✓ Tabular family rosters, pre-filled/ pre-loading of data, skips, validations,
- ✓ complex multiple choice questions, mandatory questions, double entry checks, answer confirmation,
- ✓ error feed back, post-completion review, location (GIS), media (photo), and open questions, ...
- ✓ How quickly can be paper based survey be converted into mobile format?
- ✓ How long does it take to modify or update the mobile-based survey instrument later?

Deployment and Storage:

- ✓ Can data entry formats be updated remotely on the devices?
- ✓ How much data can be stored on the mobile devices?
- ✓ Can the data be edited after the data entry?
- ✓ Does it create back-ups?

Monitoring

- ✓ Does the system/software allow monitoring and tracking field staff in real time while data is being collected?

Selection ...

Data Security

- ✓ *What kinds of data security features are included within the software?*
- ✓ *Is access to the software password protected? Is the data encrypted?*
- ✓ *Do these features meet our requirement?*

Control and Management

- ✓ *Manage the software/ system*
- ✓ *Update survey instruments*
- ✓ *Control field staff access to the surveys and data*
- ✓ *Access collected data in real time through the system*
- ✓ *Kinds of technical skills needed to manage*

Time Frame and costs:

- ✓ *Does the software platform and service provider fit timelines and budget?*
- ✓ *Kinds of mobile devices to be purchased?*
- ✓ *Expected trade-offs in terms of mobile device features requirement versus timelines and costs?*
- ✓ *Smart mobile devices that allow for Mobile apps with “form based interfaces” for data entry, location (GPS) tracking, and media (photos) and bio-metric data capture.*

Selection ...

CSEntry Android app

- ✓ Data entry applications can be run on Android phones and tablets.

Features:

- ✓ Design, create, and test census and survey questionnaires using CPro on Windows
- ✓ Collect data seamlessly on both Android and Windows platforms
- ✓ Export data to Excel, Stata, SPSS, and other formats

Data collection features:

- ✓ Skip patterns, Robust error and consistency checking
- ✓ Rosters allow for blocks of repeating questions
- ✓ Use reference files for panel surveys
- ✓ Multiple language support,
- ✓ Implement complex logic using the CPro programming language

OpenDataKit (ODK)

Ethiopia: EPHI

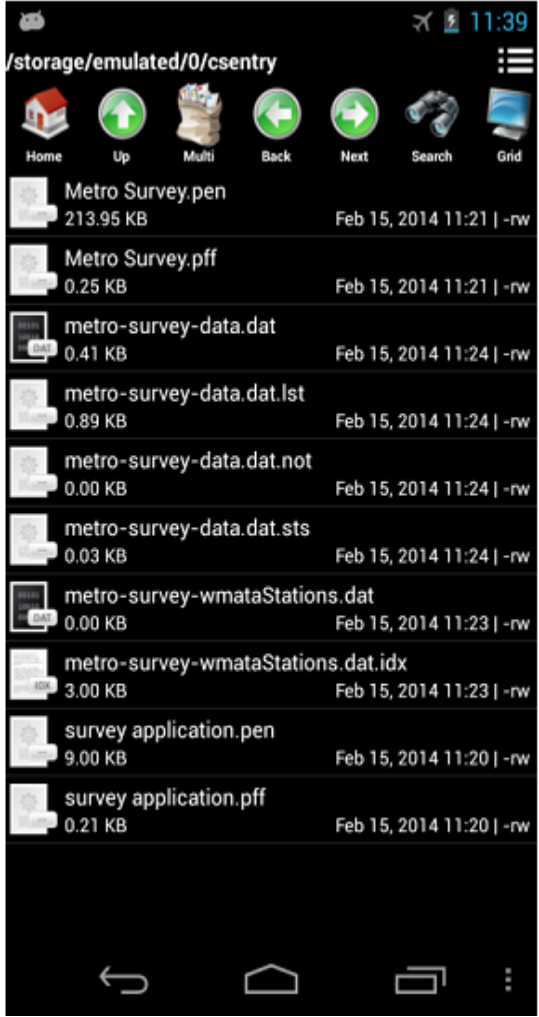
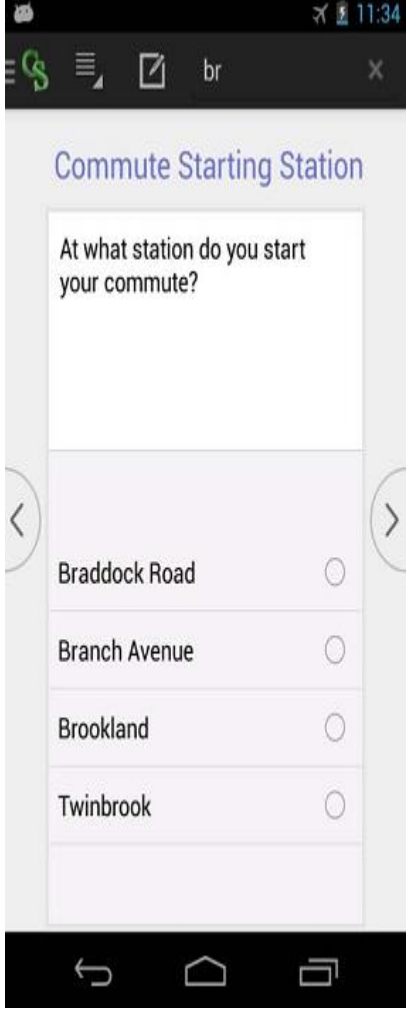
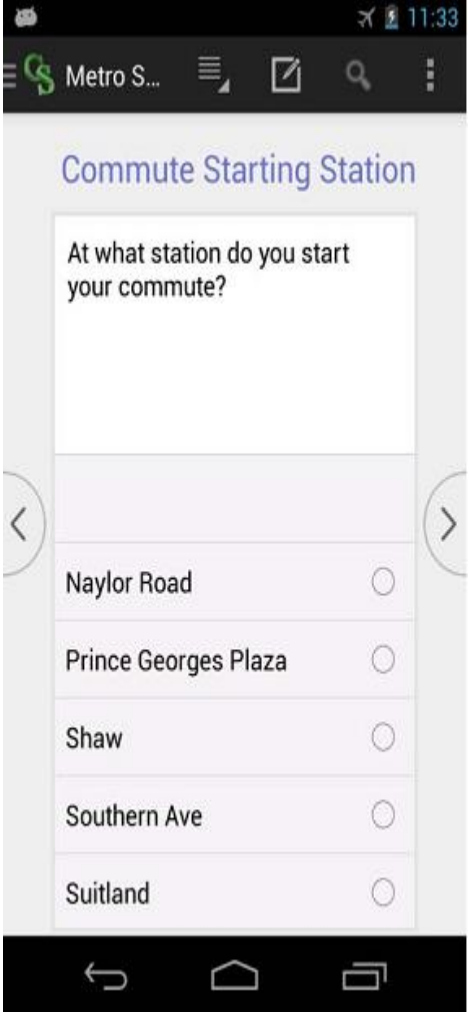
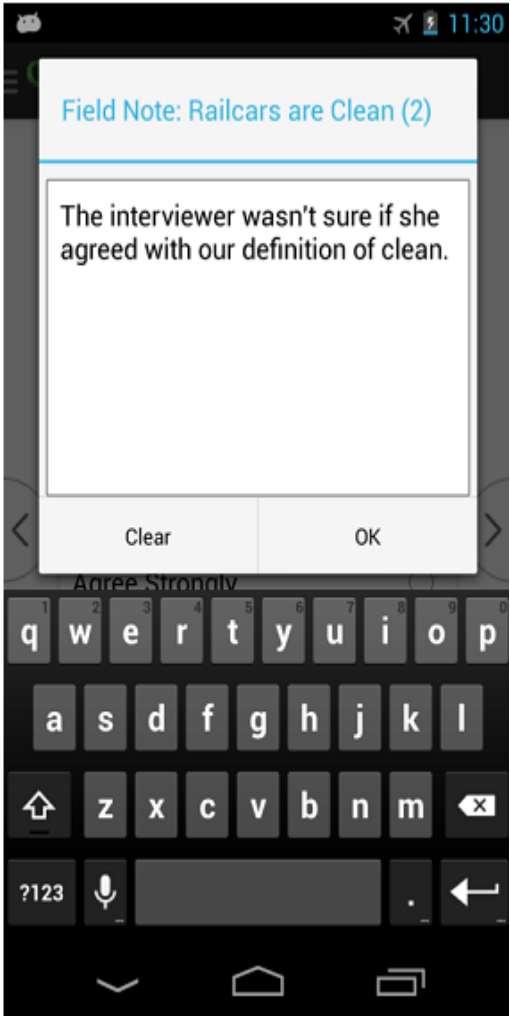
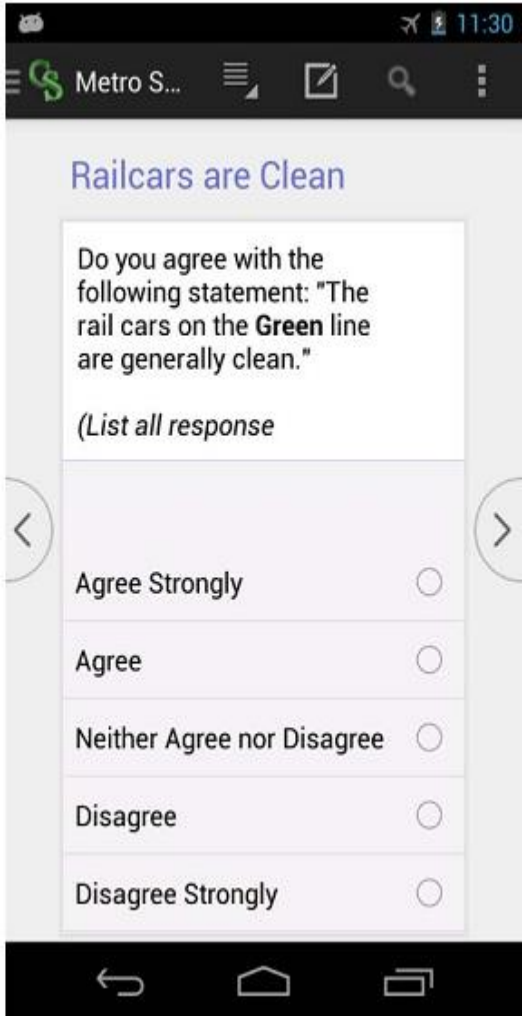
- open-source
- design a form ([Build](#) or [XLSForm](#)), setup a server (collect), and connect the device to that server (aggregate)



Ethiopia: WaterAid

- Data capture: Activities include, census, audits and inspection checklists

CSEntry feature...



Institutions in Ethiopia

- *Several institutions work on IT development in Ethiopia*
- *Ethio Telecom:*
 - ✓ *Mobile Network, internet connections, Wi-Fi,*
 - ✓ *SIM card, CDMA, ...*
- *ELPA power supply*
- *Other institutions vis-à-vis Mobile devices use practice in Ethiopia*
 - ✓ *Research institutions and development organizations*

Testing Mobile Devices for Data Collection: Ethiopia Pilot

- ✓ *Proposed and funded by ECA*
- ✓ *Partners employing: ESA, CSA and ECA*
- ✓ *Pilot Survey: Price Statistics*

Status of the Pilot

- ✓ *RTI identification and Agreements signed off*
- ✓ *Plan of action amendment and*
- ✓ *Working team established*
- ✓ *Presentations made on the launching event:*
- ✓ *Logistics preparation*
- ✓ *Consultants identification*

Work Plan

Manual development

- ✓ *Mobile Device Application*
- ✓ *Survey design and Methodology*
- ✓ *Survey Questionnaire (Tools)*
- ✓ *Software (Template) design*
- ✓ *Template installation, data collection application on mobile device*
- ✓ *Linking devices with:*
 - *multimedia: Photo, Audio, Recordings and video tools*
 - *Geographic data (Latitude, Longitude, Altitude): GPS: Location, Paths, area and Boundaries*
 - *Extra add-ons: Electronic sensors - fingerprints, scanners, smart cards and readers; wherever necessary*
- ✓ *Data transmission from fields to central database*
- ✓ *Data base management and datasets*
- ✓ *Data security*
- ✓ *Access and data sharing*

Work ...

Training for partners and enumerators for data collection

- ✓ *Application of mobile device*
- ✓ *Software installation*
- ✓ *Tools and Application: Collection of data using devices and transmission*
- ✓ *Pretest practices*
- ✓ *Pretest evaluation before deploying for actual enumeration*
- ✓ *Surveys*

M & E

- ✓ *Data quality, Coverage, Reliability and timely data*
- ✓ *Feasibility and conformity of:*
 - *Chosen device*
 - *Desirable features of the app*
 - *Available resources*
- ✓ *Connectivity and network coverage*
- ✓ *Logistic and practical challenges*
- ✓ *Remote areas in line with survey design*
- ✓ *Data security and privacy*
- ✓ *Validation*

Work Plan: Schedule

No.	Activity	Implementing Partner	Time frame (d/m/yy)
1.	Prepare a documentation describing the current status of the use of mobile technologies for data collection in the study area	ESA, CSA	10/11 - 24/11/14
2.	Propose the local partners that will serve as self-reporting data providers for the project	ESA, CSA	
3.	Organize the national workshop for all the project implementing partners to identify and to agree on the modalities of each partner to implant the project	ECS, CSA, ECA	25/11 - 04/12/14 (04 is event day)
4.	Procurements	ECA	December 2014
5.	Develop concepts, methodologies and applications for geo-enabled mobile data collection systems (customize, adapt or develop new software as appropriate)	ESA, CSA	01/12 - 31/01/15
6.	Prepare the training materials (guidelines on geo-enabled mobile data collection methods)	ESA, CSA	02 - 16/02/15
7.	Organize the national training workshop to equip the data providers with the developed technology	ECS, CSA, ECA	21 - 25/2/15
8.	Undertake & Coordinate the data collection fieldwork	ESA, CSA	25/2- 16/3/15
9.	Final Report Submission	ESA, CSA	31 March, 2015

Expected Challenges

- ***Hardware devices related***

- ✓ *When large number of devices needed: If purchase is not planned in advance, bad option to buy different device models*
- ✓ *Battery and charging: regular usage of mobile devices require daily charging. Rural areas, electricity is limited*
- ✓ *Memory: devices may have limited memory - data loss -SD card may be needed (extra cost)*
- ✓ *Device depreciation: battery problems, broken and loss of devices. Put penalties into enumerators to look after*

- ***Software related***

- ✓ *Security: data stored on mobile devices can be accessed if not encrypted or password protected*
- ✓ *Multimedia handling: large amounts of multimedia can delay transmission of data*

Expected ...

- ***Logistics related***

- ✓ *Billing and top up: difficult to track mobile usage by field staff*
- ✓ *Running out of mobile credits, if happens (for pre-paid services)*
- ✓ *Training: needed both on software and use of mobile devices*
- ✓ *Field staff switching SIM cards: tracking them by their phone number becomes tricky*
- ✓ *Theft: Mobile devices, expensive and small - easy targets for theft*
- ✓ *Costs:*
 - *Battery - need extra batteries charged for a device to avoid risk from power interruption*
 - *Loss or damage of devices - need replacement and/ or maintenance costs*

- ***Data related***

- ✓ *Data loss: due to mishandling of software, deletion of software or when data is transmitted*
- ***Network coverage limitation and slow access***
- ***Electricity access coverage and power interruption***

Sources:

- <http://www.theclearinitiative.org/resources-art2.html>.
- Croke K. (2012). Collecting High Frequency Panel Data in Africa Using Mobile Phone Interviews. Policy Research Working Paper 6097. World Bank.
- CSEntry for Android Beta Documentation.

Thanks!